UNIV. OF

# SCIENTIFIC AMERICAN

*A Weekly Review of Progress in*

INDUSTRY · SCIENCE · INVENTION · MECHANICS

ERECTING PORTABLE HANGARS BY INFLATING THEM.-- (See page 483)

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GMC

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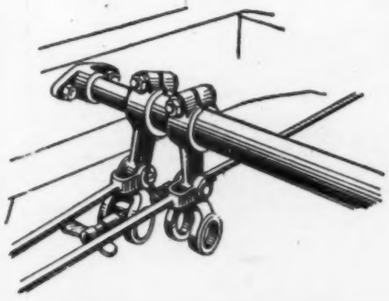
## —on Dairy Routes



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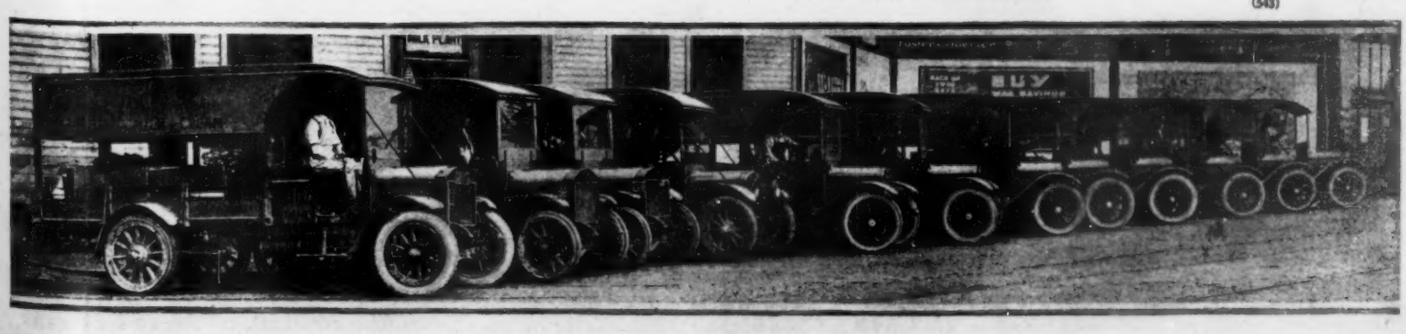
(543)



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SEVENTY-FIFTH YEAR

# SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXI.] NUMBER 20 NEW YORK, NOVEMBER 15, 1919 [10 CENTS A COPY $5.00 A YEAR

## THE NEW WELLAND CANAL

While the difference in level between Lakes Erie and Ontario furnishes us with the beauties of Niagara and while it is the means of developing many thousands of horse-power for man's use, yet it has its disadvantages for navigation, only overcome by the construction of artificial waterways. With thoughts once more turned to peaceful arts, Canada has resumed her work of enlarging the Welland Canal, a task second in magnitude only to that of uniting the Atlantic and Pacific Oceans at Panama.

In all, three canals will have been built between Lakes Erie and Ontario. All more or less closely follow the same route. In 1824 the first ditch was commenced, and on completion in 1833 it afforded passage to vessels 150 feet long, the smallest of the 27 locks being 150 feet long, 26½ feet wide, and carrying 10½ feet of water over the sills.

This early canal sufficed until 1872, when construction work was commenced on the canal now used for interlake traffic. This canal is somewhat shorter, has fewer locks, and deviating from the old one above Thorold, enters Lake Ontario at the same point, Port Dalhousie. The locks in this canal are 25 in number and are 270 feet long by 45 feet wide, with 14 feet of water over the sills.

The canal now under construction is to be still shorter and instead of 25 locks will have but seven. The elimination of 18 locks and the rapidity with which the remaining ones can be filled will mean a saving of three hours in the time taken to traverse the canal. The valves and culverts in the walls of the locks will be of such large dimensions that less than eight minutes will suffice to get a vessel through each lock.

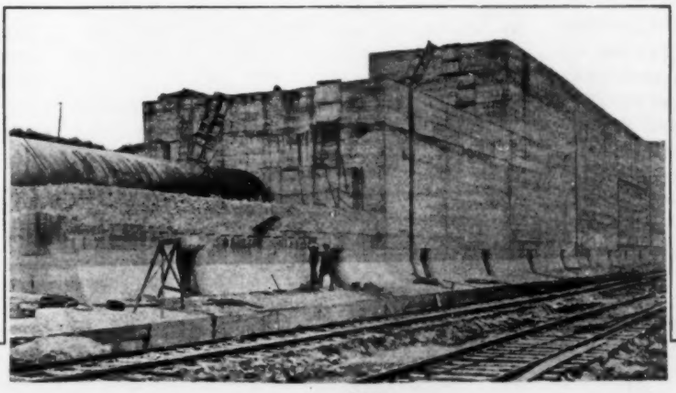
Each of the locks will be 42½ feet lift, 80 feet wide, and sufficiently long to accomodate a vessel of 800 feet. Thirty feet of water will be available through the locks and while the reaches for the time being will only be 25 feet deep they can readily be dredged out to 30 when required. The total length of the canal will be 25 miles and the aggregate difference in elevation to be overcome between its two termini is 326½ feet.

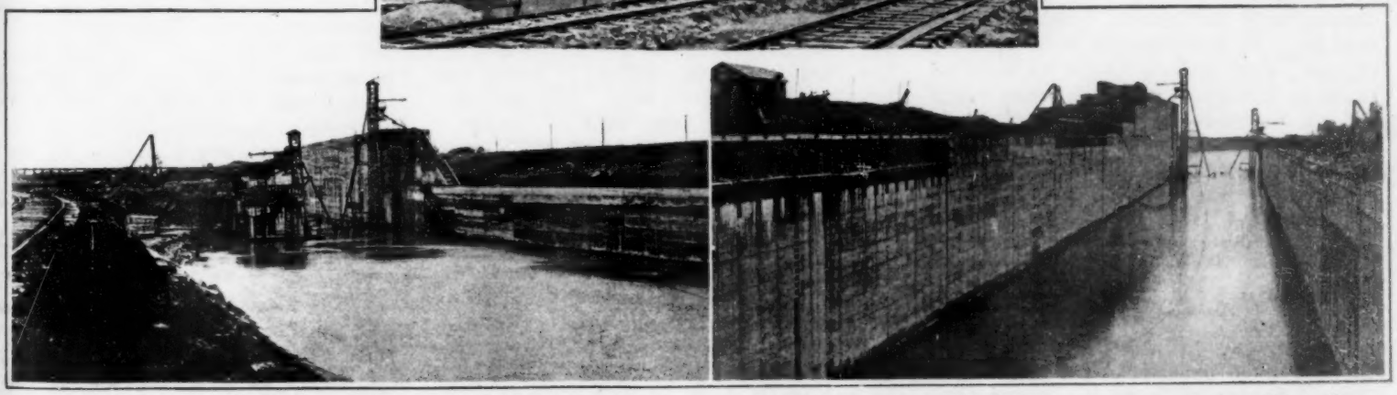
The lock walls will be 82 feet high above the top of gate sills, and including necessary foundation work two of the locks will have walls 100 feet high. Three of them will be built in flight and will be double. One of the flights will be used for vessels bound down-stream and the adjoining one for those up-bound, the double flight being required here to save long delays in the passage of vessels through the canal.

The lock gates will be of the swinging type, single leaf, with hinges at one side and resting in a notch in the opposite wall. The gate at the foot of each lock will be 83 feet high and will weigh in the neighborhood of 1100 tons.

A guard lock will be placed near the Lake Erie entrance to the canal, and just before lock seven is reached

(Continued on page500)





Above: the discharge openings and a portion of the conduit by means of which the water level is altered in locking vessels through the canal. Left: the canal prism in its present flooded condition, due to cessation of work during the war. Right: a general view of the concrete walls of the new canal locks.

VIEWS OF THE NEW WELLAND CANAL

# SCIENTIFIC AMERICAN

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## NOTICE TO OUR READERS

Owing to the printers' strike in New York City, we are obliged to continue our typewritten numbers. We beg the indulgence of our readers while we are publishing under obvious difficulties, and with unavoidable delays.

## THE STRIKE PROBLEM

Although the SCIENTIFIC AMERICAN, as our readers well know, has been the victim of a local strike which has injured its appearance and cramped its regularity of issue, its troubles are very small compared with the graver ills of the labor situation throughout the country. The present upheaval is an inevitable sequel of the war. The disease of unrest is a natural result of the mental inequilibrium which has pervaded the whole world, and made the war possible in the first place. As a consequence of the overturning of the ordinary laws of supply and demand, the prices of all commodities have risen, not only in this country but everywhere. This rise has, naturally, produced an increase in the value of labor as such. As the cost of living soars, of necessity the price which must be paid for labor goes up in proportion.

The strikes that have sprung up all over the country since the armistice was declared are partly due to this condition but partly they are due to causes very different, and far less worthy. In the demands made by many of the labor unions there is evident purpose not merely to increase wages but to decrease production. We do not know how much this is to be attributed to an honest belief that the less each worker produces, the more jobs must be created to maintain the necessary production, and how much to the mere selfish desire to render less return in work for the wage received. We do know that there never was any period in the world's history when such demands were so out of place. We are at a crisis where the world's production must be increased, not diminished; and every concerted move in the wrong direction is to be regarded as an attack on the public weal. In direct ratio with the success attendant on the organized methods being put forward to decrease our output, this country will flunk out the great opportunity offered it of swelling its commercial prosperity to a point never before attained.

The disorder from which we are suffering is a mental one. The first step toward a sure cure is by recognition of that disorder and the next is to devise some means by which the disease may be arrested. One of the immediate moves to be made is in the direction of an enlightened public opinion. The facts that have come out during the past few months, as a sequence of the strikes, make clear certain fundamentals.

It is granted that increased living costs involve the necessity for better wages. The shortening of hours, however, except in such cases as are seen to involve improper living conditions, should be regarded with the gravest suspicion. Every such demand should be forced to stand on its own merits; the claim for a shorter week in so many cases is so utterly lacking in real justification, and carried to such extremes, that no general principle of lessened hours will safely serve. The price which the entire country must pay for the lessening of output that would inevitably follow the wholesale adoption of a 50 or a 75 percent week is a thing to which our continued existence as a great industrial nation forbids us to submit.

It is, therefore, up to the members of every union to satisfy themselves that the leaders who represent them are worthy of their confidence, and are not luring them in the wrong direction, from selfish motives and to increase their personal prestige and power. The agitation of the past few months has brought to thesurface a very significant fact, which must be borne in mind in considering the future of the socalled labor movement. The line is being gradually drawn between those who have legitimate claims that are deserving of attention and who are being led by fair-minded leaders seeking only for what is just, and those who are led by unbridled radicals prepared to sacrifice society and the country for their own selfish ends.

The rapid industrial growth of the United States brought about a heavy demand for foreign labor, which our liberal immigration laws have helped to satisfy. We must now consider whether we have not paid too high a price, whether we should not be better off had we advanced commercially and industrially more slowly and developed a body politic in which we might have more confidence.

We have been apt, in the past, to pride ourselves in the "melting pot," but Theodore Roosevelt once warned: "Don't mistake the melting pot for a polyglot boarding house." And it becomes clear that for some time past the melting pot has not been working.

It has these many years been recognized that a considerable percentage of our immigration was of a very undesirable sort. The dregs of Europe were being unloaded upon our shores. These people came here without any knowledge of or interest in our country or our institutions. They were looking merely for new fields of labor and new conditions of life. They have been very generally uneducated and they have remained ignorant; they have been without loyalty to the country and they knew nothing or cared nothing for our form of government; seldom of course could they speak our language and in a vast number of cases they have made no effort to learn it.

It seems evident that here was a prolific field in which a dangerous agitator could operate; and it is amongst just such material that most of the agitation has taken place. It has been apparent that these disorders were in many cases true strikes in no sense of the wrod save their outward form. The essential motive has been, not to correct the industrial system, but rather a desire for disorder as such, a yearning to introduce un-American ideas, to produce discontent, to foment trouble. It has become very clear that no wage increase or shortening of hours will cure such a disease. There has been a glorious opportunity for the demagogue, the political agitator, the fanatic, the anarchist, the worshipper of social unrest. The field was admirably adapted for the operations of such as these. They have realized that this period of readjustment was the golden chance for them to accomplish their fell and selfish work of destroying the social fabric.

In the great steel strike it is established that the thousands misled into doing the bidding of such as these looked upon the strike as indeed no strike at all, but as "the revolution." We have little doubt that the same thing is true in many other cases. It behooves those unions that pride themselves upon the high level of intelligence of their members to watch their step with the utmost care, lest they be led into actions contradicting that claim, and placing them on a level with the unassimilated foreigner.

## Electricity

THE NEW HEATERS. - Although introduced but a few years ago, the round electric heaters have now become the most popular form of electric heating appliance. Aside from a very neat appearance, the main reason for the popularity of the round heater is its very high efficiency. Indeed, instead of spreading the heat in all directions, the round heater concentrates its heat very much after the fashion of a searchlight. The result is an intense heat where the heat is really needed, instead of very little heat dissipated over a wide area. The best heaters of this type use a solid copper bowl.

COLORATION OF ARC LAMP GLOBES. - It is well known that arc lamp globes tend to assume a purple coloration under the action of light, a phenomenon due to the presence of manganese which is used to counteract the greenish coloration which would otherwise take place owing to the effect of ferrous salts in the glass. Mr. M. Luckiesh, writing in a recent issue of the Electrical World, suggests that in specifications for arc lamp globes it should be prescribed that no manganese is to be used. This would avoid the coloring effect (which may involve ultimately 50 per cent absorption), and for outdoor globes the slight greenish coloration would not be of great consequence.

LOCATING OIL BY ELECTRICAL MEANS. - The idea of using current transmitted through the earth as a means of locating metal ores is familiar, the idea being that the greater conductivity of these metalliferous regions can be clearly indicated, and the area mapped out. The location of oil deposits, which according to the Electrical Review is now being investigated electrically, presents a converse problem. In this case the insulating properties of the oil diminish the current and oil-bearing regions are detected accordingly. In view of the great depth to which it is often necessary to bore for oil - oil that may exist simultaneously with an almost oil-free area above - the method would seem to have limitations, but it has doubtless possibilities in dealing with surface oil-areas.

FISHING BY MICROPHONE. - Norwegian fishermen are using a species of submarine telephone to aid them in their work. A microphone is lowered from a fishing boat and connected by a wire to a telephone in the boat. The fisherman listens at the instrument and when the fish hold a meeting the listening device records the disturbance

## Science

THE DEATH RATE for New York State during the quarter ending with August was the lowest ever recorded for the state. It appears that many who would normally have died during this period succumbed to the influenza epidemic of the previous winter. It would be of interest to learn whether serious epidemics are not normally followed by a period of low death rate.

WROUGHT MANGANESE RODS, exposed to corrosion in water and moist air, while at the same time under tensile stresses were found by the Bureau of Standards to have suffered no greater weakening from the combination of trying circumstances than would have been expected on empiric grounds. As compared with specimens subjected to the same stresses but protected from corrosion, however, they showed the expected inferior performance.

THE FIRST MOVABLE METAL TYPE, made and used in Korea in the year 1403, are now on exhibition at the American Museum of Natural History, New York. The slugs are concave on the under side, in order to make them cling more firmly to the beeswax bed which cinstituted the form. Printing was carried on by placing the paper lightly upon the type and then brushing the other side gently with a piece of felt.

FILM RECORDS as a source from which future generations may reconstruct effectively the history of todayhave had their share of attention, and a goodly number of them have been laid carefully away for this purpose. A feature of this procedure to which attention has not been called is the increased fire hazard which its general adoption would create in our schools and museums. A large stock of celluloid is excellent material for a conflagration, and this possibility should be well guarded.

RADIUM ECONOMY - The use of radium on a large scale therapeutically involves danger of loss, and this factor has been a big one in inducing hospitals and clinics with a gram or more of the element in use, to utilize radium emanation instead of applicators containing the radium itself. There has been installed in a Pittsburgh labaratory an elegant and useful apparatus for the collection, purification and tubing of radium emanation obtained from a salt of the element. It differs from earlier apparatus in that liquid air is replaced by chemical means of purifying the emanation, which are felt to be more reliable.

## Aeronautical

'ROUND THE WORLD AERIAL DERBY. - The Aero Club of America has recently announced an aerial derby around the world, being organized under the auspices of that club, for which efforts are being made to secure a prize fund amounting to $1,000,000. A special commission has been appointed.

BRITISH PASSENGER AIRSHIPS. - The Northern Aerial Syndicate is said to be arranging a passenger-carrying air service to the United States. The plans are for airships carrying 150 passengers, in addition to staffs of cooks, stewards, and crew, to serve westbound and eastbound passages between England and New York. Perth, Australia, will also be served, seven days being allowed for this trip. At liverpool passengers for America will be transferred to smaller aircraft to their destination. Moorings will be procided at leading hotels.

LOSSES AT OUR FLYING FIELDS. - Announcement was made by the General Staff of the U. S. Army some days ago that since January 1st, 1918, the Air Service has had 390 fatalities at American flying fields. Of these 14 or 4 per cent were attributable to the failure of engines or the collapse of airplanes. The causes of 9 per cent of all fatalities were declared to be unknown. The causes, total numbers, and percentages of all accidents were given as follows: tail spin, 118 or 30 per cent; collision, 61 or 16 per cent; nose dive, 47 or 12 per cent; unknown, 36 or 9 per cent; side slip, 21 or 5 per cent; stall, 19 or 5 per cent; fire, 15 or 4 per cent; failure of machine, 14 or 4 per cent; struck by propeller, 13 or 3 per cent; miscellaneous, 46 or 12 per cent.

SPEEDS AT HIGH ALTITUDES. - According to the experimental data in the possession of the technical sections of the Air Service it has been found that at a height of 20,000 feet an engine gives only 45 per cent of the power for which it is good at sea level. The great value of the surcharger now being used with some engines lies in its ability to make a motor yield the same power at 20,000 feet that it does in flying at the lowest altitudes. Whereas the Lepere biplane, recently used by Major R. W. Schroeder in an altitude record flight of 31,800 feet, with one passenger, is capable of a speed of 136-137 miles per hour at sea level, at 25,000 feet, where most of the air fighting is expected to take place in the next war, the machine equipped with the surcharged has shown a speed of 134 miles.

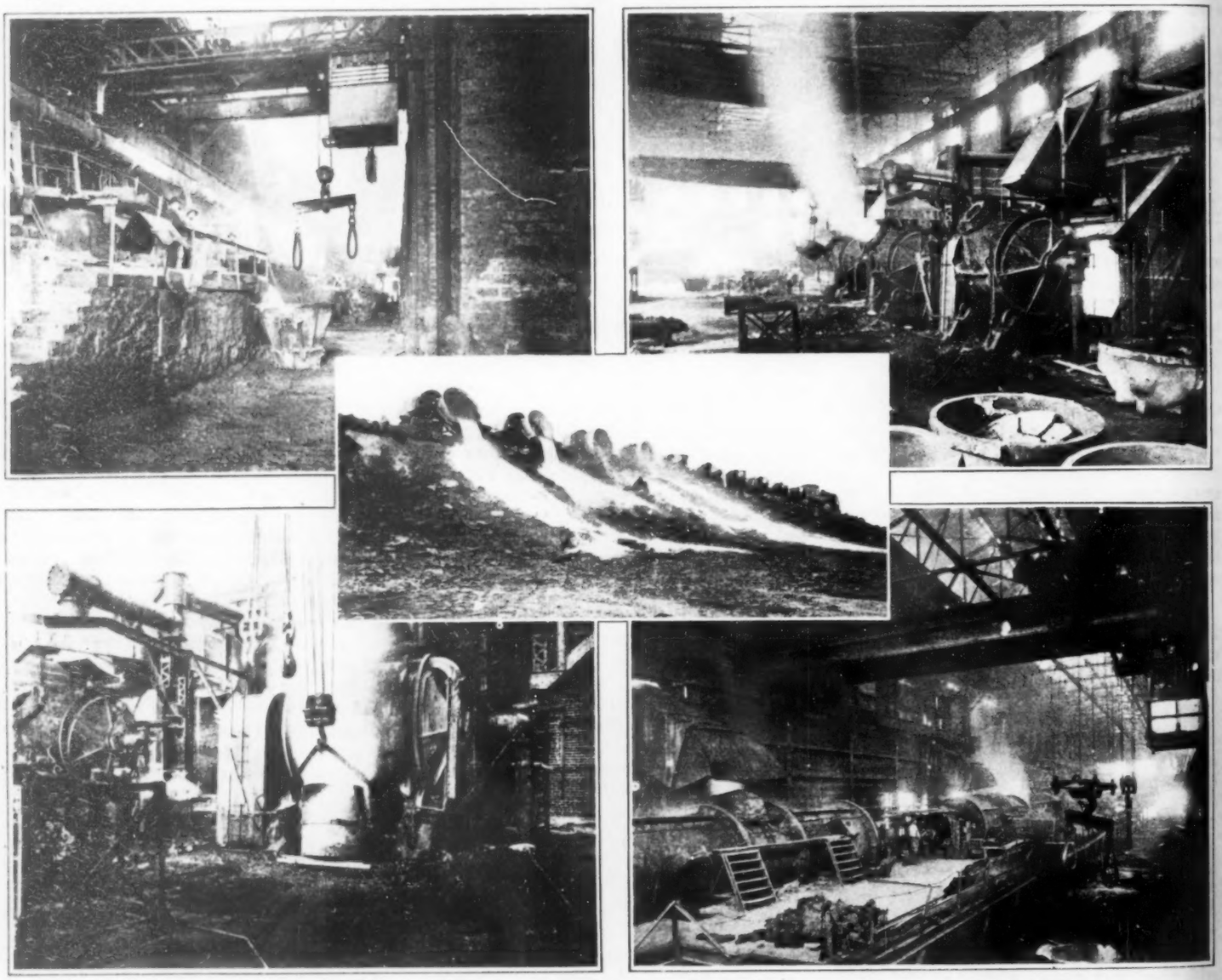
# THE STORY OF NICKEL

WHERE IT COMES FROM, HOW IT IS OBTAINED, AND THE USES THAT ARE MADE OF IT

By W. F. SUTHERLAND

From earliest times when man first learned the art of working bronze, his very existence has been dependent in some measure at least upon his ability to use various metals to his particular needs. And while copper and iron have been most essential to his well-being and progress, other metals, as gold, silver and tin, have been of much value to him throughout the ages, either for his everyday wants or for ornament. It is only within the last century, however, that nickel has assumed the importance its properties justly may be said to earn for it.

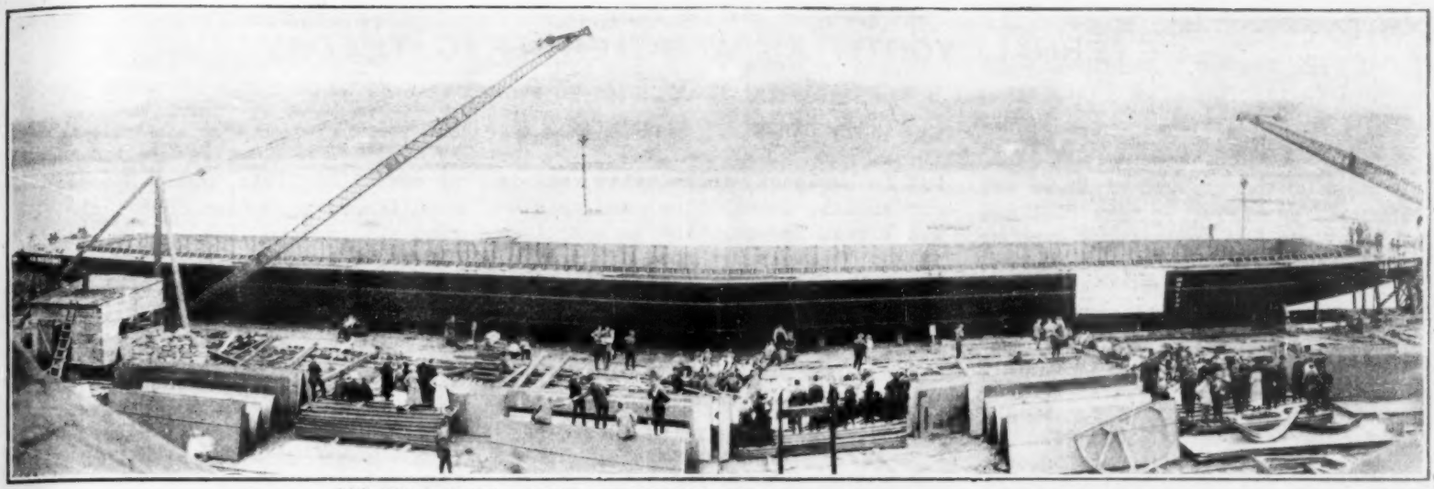
Its brightness, non-corrosive properties and hardness render it one of the most useful of metals, and as nickel-steel it has been almost indispensable in the recent years of strife; for, combined with iron in varying proportions, it has rendered possible the development of the ordnance and armor so necessary to modern warfare. The same properties of toughness and strength so useful in the arts of war also find their role in peafeful industry; and nickel-steel is being used for bridges, for other structural work, and in many high-quality products of the forge and machine shop.



Upper left: Teeming the blast-furnace matte from the smelting basins. Upper right: The copper converters at Port Colborne. Center: Slag dump at Copper Cliff, an impressive scene by night. Lower left: Pouring molten blister copper from a converter into the casting ladle, after it is separated from the nickel. Lower right: The last stage of the conversion process before the matte is shipped to be refined.

THE STORY OF NICKEL

Invar steel with 36 per cent nickel has the property of varying little in length with change of temperature and so is of great value for surveyors' tapes, standards of length, clock pendulums, and other similar



300-FOOT STEEL BARGE BUILT FOR THE MISSISSIPPI RIVER TRAFFIC

uses. Nickel steel is, indeed, no novelty; all native iron, terrestrial as well as meteoric, contains it in varying proportions. Native iron found in Greenland shows up to six per cent of nickel and meteoric iron

(Continued on page 492.)

STEEL BARGES FOR MISSISSIPPI RIVER

History is repeating itself in the matter of freight traffic in the United States. Originally the bulk of our goods was shipped by canal and river; later the raulroads began to take over more and more of the traffic. Today, despite the vast network of railroads extending over the entire country, we find the waterway again coming into its own as a means of handling freight on a large scale and at rates that make these routes well worth considering.

Typical of this revival is the huge steel barge illustrated. This was constructed at Minneapolis for use by the Government in the upper Mississippi. It is 300 feet long and 48 feet wide. Over 50 tons of 3/8-inch steel plate went into its construction. It has 2,500 tons capacity, and, unloaded, a draft pf 18 inches. Its main cargo hold is 38 feet w le, 250 feet long, and 6½ in depth. Surrounding it on four sides and bottom are 20 oil compartments, which can care for 250 tons of oil.

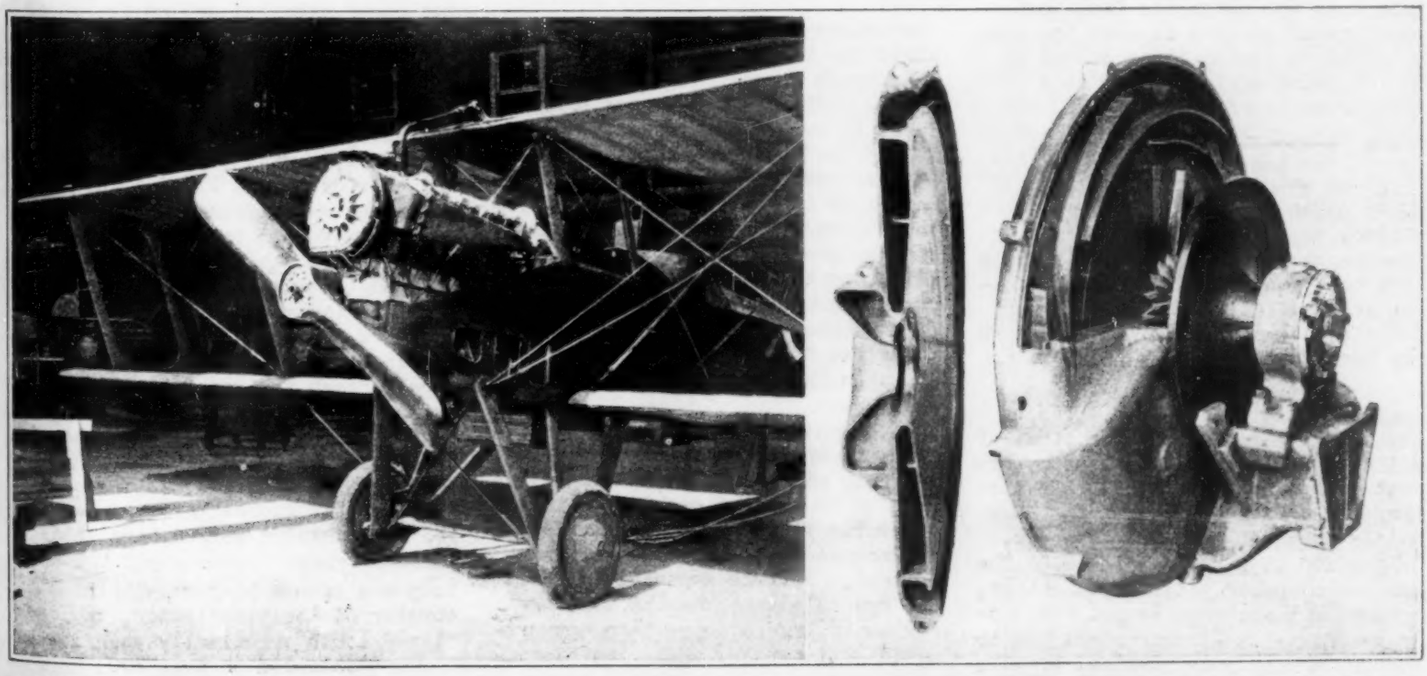
BOOSTING THE CEILING OF THE AIRPLANE

One thing in aviation is certain, and that is the loss of engine power at great altitudes. Thus a 200-H-P engine becomes a 100-H-P engine at 25,000 feet altitude; and this very fact serves to put a definite limit on how far up an airplane can climb, or, to fall back on the phraseology of the airmen, on its ceiling.

It has long been appreciated that if the density of the air could be maintained as the plane continued to soar upward, the engine would maintain its power irrespective of altitude and the rarity of the surrounding atmosphere. It has remained for Dr. S. A. Moss, assisted by W. A. Reeves, both of Lynn, Mass., to develop an engine supercharger which has proved remarkably successful in flight. In fact, these American inventors have gone ahead to an early successful consummation of a problem that has long baffled European aviation circles. The new supercharger makes it possible to maintain sea-level pressure for use in the engine regardless of altitude.

The supercharger is a device weigh-

(Continued on page 498)



AIRPLANE EQUIPPED WITH LIBERTY MOTOR AND SUPERCHARGER, AND INSIDE VIEW OF SUPERCHARGER, SHOWING SIMPLICITY

# ETERNAL YOUTH AS A SCIENTIFIC THEORY

A DISCUSSION OF THE PLACE WHICH VORONOFF'S THESIS OCCUPIES IN THE GENERAL FIELD OF HUMAN INTEREST

By GENEVIEVE GRANDCOURT

In view of the alleged claim of Dr. Voronoff, of Paris, to have restored youth by the implantation of a young interstitial gland in the aged, it is instructive to recall the experiments of Brown-Sequard, who is responsible for modern organo-therapy. He also tried, by introducing under the skin emulsions prepared from the secretions of young animals, tp get the results stated by Voronoff. Although subsequent investigation upon these lines has not proved altogether barren, neither has it developed anything of sufficient note to mark anepoch.

Dr. G. F. Lydston of Chicago, writing last February in the Journal of the American Medical Association, gives several instances of gland implantation similar in technique to those recently attributed to Voronoff. These operations - upon men of varying ages, in varying degrees of physical, and especially of mental, deterioration - were performed by Dr Lydston some time agp, at least one of them as far back as four years. They are interesting from the scientific point of view in that they afford further and detailed experimental data regarding the relation that exists between senile decay, including its precocious manifestations, and disturbance of the reproductive function.

Whether Voronoff has, or has not, doneanything new in the same direction does not alter the fact that the general problem is much too complicated to regard it as solved by the throwing of light upon some particular angle of it. In fact, anything approaching a detailed technical discussion would be equally out of place and out of the question in these pages and this space. But the subject is one of such far-reaching importance that it seems worth while here to attempt to give it its general orientation, regardless of any definite value which Voronoff's work may turn out to possess or to lack.

## THE NATURE OF THE PROBLEM

We have inherited the idea, that of all things death is the surest. Now what we see as living matter is distinguished from what we see as dead matter in not being, so to speak, "satisfied to remain as it is." The essence of being alive is to change, even when the change is not obviously beneficial. Illustrations are to be had, not only in physical growth, but in business, in politics, and in our social, intellectual and spiritual lives. The question is sometimes asked: "What is the good of so much progress, since it brings its own problems, and often makes us as individuals no happier." Yet obviously if we do not go ahead we must go back. Nothing that lives is the same today as it was yesterday.

Hence, logically, life should have no part with its antithesis, death; and modern science indicates that, fundamentally, perhaps it has not any part with it.

For example the first forms of life, the microscopic, one-celled organisms, the protozoa, do not die. When they are, as it were, ready for the next generation, the single cell divides with the result that there are two of a kind, equally old and equally young, where before there was but one. This is equivalent to entering upon a new stage of life without leaving behind any remains.

Whatever else such a change may be, it is admittedly not death. It is when the cells, multiplying to build tissue, incidentally evolve the many celled forms (metazoa) that death ensues. It would seem, therefore, that death must be the compensation exacted of life for complexity of structure; and the gist of the matter is to know whether, and to what extent, this applies.

## POTENTIAL IMMORTALITY IN METAZOA?

Botanists tell us that trees have lived for thousands of years, then to succumb to earthquake or tempest alone. Witness the famous Dragon-Tree, in Teneriffe, uprotted by a storm; the Sequoia gigantea of California; the Mexican cypress; and the baobab of Cape Verde. By way of recalling the method employed to determine the age of the latter (estimated, by the way, as exceeding 5000 years) it might be mentioned that a French naturalist, after uncovering the first 300 layers of its wood, found an inscription dated 300 years earlier.

In contrast with this tenacity of trees is the trouble often experienced by gardeners, in keeping alive some of the lesser members of the vegetable kingdom. Yet by simple interference with their time of going to seed, certain annuals, notably the rye cultivated in the Cossack region of Russia, have been converted into biennials; while the biennial beet-root lives, under special conditions, more than double the period assigned to it.

If it be true that the very complex fruit-bearing properties of the annual plant involve the secretion of a poison, less harmful in its immediate effects upon the biennial, and still less so to the perennial, may we suppose that some analogous death dealing process has been dispensed with - overcome - in the potentially immortal great trees?

## WHAT ABOUT THE ANIMAL KINGDOM?

All too short is the span of life allotted to our fireside friends,the dog and the cat. The sheep is practically in its extreme dotage at 14. Yet the age of certain reptiles is considered well-nigh incalculable, and two tortoises living at different periods in the palace of Canterbury are known to have survived captivity, respectively, by 128 and 107 years. A third, brought to the island of Mauritius in 1765, is still, apparently, very far indeed from old age.

Humboldt is often quoted as saying that a certain bird outlived an extinct tribe of savages. Whether his information was reliable or not, the eagle, eagle-owl, swan, vulture, raven, falcon, all own a lease of life so extended that it has passed into legend.

Man's longevity surpasses that of the other mammals; and he is rather inclined to believe the stories handed down that his race once attained an age out of proportion to anything like the present average. When the charlatan Cagliostro got credence of more or less weak-minded people for his tale of having lived a thousand years, he was playing on a tendency latent in us all to feel that life is too short, that it is unreasonable and (in view of the comparatively great ages attained by individuals here and there) perhaps even unnecessary that we should so often barely reach full usefulness when we are called upon to die.

Lejoncourt cites, among centenarians, a Norwegian of 146 who had been a sailor for 91 years; while we have all heard of Thomas Parr, dying at 153 after having worked hard until a score of years previously. His dead body was opened by Harvey, the discoverer of the circulation, and declared to be organically sound, with

(Continued on page 490)

# Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

## KIND WORDS FROM OUR READERS

To the Editor of the
SCIENTIFIC AMERICAN:

Please accept my congratulations on your issue of October 25th. It is so typical of our American determination to overcome obstacles, that it ought to be emphasized. I have wondered many times how you were making out, and whether your record of years would be broken. It certainly is inspiring to see the paper keep coming. It is like a hot World's Series baseball game. We hope you will win, but we realize what a big proposition you are up against.

This typewritten issue with its long hand editorial sheet will be kept as a souvenir of one of the extraordinary things that happened in this wonderful year of 1919. My father took the SCIENTIFIC AMERICAN regularly, and the paper has been in our family more years than I am old. I distinctly remember asking my father about the illustrations before I was able to read. So, don't miss an issue.

HIRAM PERCY MAXIM

Hartford, Conn

To the Editor of the
SCIENTIFIC AMERICAN:

Just a few lines in appreciation of the indomitable spirit displayed in getting out Volume CXXI of the SCIENTIFIC AMERICAN against almost insuperable conditions.

W. R. WOODWARD

New York

To the Editor of the
SCIENTIFIC AMERICAN:

We want to congratulate you upon your issue of October 25.

It is high time that the Bolshevistic tendencies of some of our labor organizations be curbed.

We are glad to see that the SCIENTIFIC AMERICAN has in this manner shown its ability to appear without assistance of the compositors.

SERVICE MOTOR TRUCK CO.

Wabash, Ind.

To the Editor of the
SCIENTIFIC AMERICAN:

Bravo! Also hurrah! And hearty congratulations on the lithograph typewritten issue which has just come to hand. Any one who says the SCI. AM. is seventy four years old has his adjectives mixed - only a sheet seventy four years young could have pep and punch enough to do a thing like this.

I always have been proud of being connected to the sheet - I'm prouder than ever to-day.

More power to you all!

C. H. CLAUDY

Washington, D. C.

To the Editor of the
SCIENTIFIC AMERICAN:

Congratulations on the type-written magazine; but I hope you will soon have your machines fitted with certain indispensable accents and other signs. I have 96 characters on the machine with which I contribute, and wish for more.

C. F. TALMAN

Washington, D. C.

To the Editor of the
SCIENTIFIC AMERICAN:

Permit me to compliment your ingenuity in getting out your last issue. This use of one's head is truly refreshing by contrast with the helplessness exhibited by the majority of the human specie.

(CAPT.) W. E. JACKSON

Walden, N. Y.

To the Editor of the
SCIENTIFIC AMERICAN:

I am much interested in your issue of October 25th, and admire the way in which you have met your difficulty. I hope you may soon again breathe freely.

C. A. CHANT

Toronto, Ont.

To the Editor of the
SCIENTIFIC AMERICAN:

Your interesting publication of October 25th will be preserved as a souvenir, and I wish to congratulate you upon the ingenuity by which you have overcome the handicap placed upon the printing industries by Unionism and their later day methods.

As far as I am concerned I do not think that you owe us, your subscribers, any apology. On the contrary, I would be satisfied to receive a one-page edition of your valued publication, if you were forced to that extremity, rather than have you succumb to the methods of an organization that seems to take the position "Union Labor Über Alles."

D. H. MULLEN, JR.

Kirkwood, Mo.

## A TOBOGGAN-SLIDE VEHICULAR TUNNEL

To the Editor of the
SCIENTIFIC AMERICAN:

In your issue of October 11th, I read with interest the suggestion of Mr. J.P.B. Casgrain, of Ottawa, Canada, to equip the tunnel under the Hudson with a moving platform to carry traffic.

Allow me to suggest a roadway for motor vehicles built on the order of a toboggan slide, with the approach built on the same grade, so that drivers could shut off offensive odors, and get a good start to negotiate the tunnel.

My idea comes from a strip of paved road, commencing at the corporation line of this city, going east, and with a gradual grade, terminates on a hill, about a mile from the city limits. This hill is of sufficient grade to enable drivers of autos to shut off, and coast the entire distance on the return trip.

J. V. V. ELDER

Mt. Vernon, O.

## HANGARS THAT ARE INFLATED LIKE A PNEUMATIC TIRE

One of the great problems that confronted the air services of the various belligerents during the recent war was the housing of airplanes at the front. Just so long as trench warfare obtained, with the contending armies immobilized, so to speak, the question of housing machines was readily enough answered by having airdromes of a more or less permanent character some distance back of the lines. But when the trench warfare changed to open fighting, with the armies on the march, the regular airdromes had to be abandoned and a portable shelter of some form introduced.

It remained for M. Gabriel Voisin, a well-known pioneer airplane constructor, to design and develop the pneumatic hangar which forms the subject of our current cover illustration. This hangar, which was employed by the French army while on the march, is made of balloon fabric reinforced with rope. The fabric is arranged in the form of an envelope, which can be inflated by means of a small gasoline-driven air compressor. While on the march the pneumatic hangar is carried rolled up to form a relatively small bundle. To erect it the envelope is spread out on the ground, the connection is made with the air compressor, and the bag is inflated in a few minutes' time. Six men can readily carry the hangar about after it has been inflated, and numerous ropes and pegs serve to brace the hangar in any position.

# THE SHOP LUBRICATING PROBLEM

## THE GREAT COST OF UNSCIENTIFIC LUBRICATION AND ITS REMEDY

By RAYMOND FRANCIS YATES

The shop lubricating problem is an important one, and yet many manufacturing establishments, both large and small, fail to recognize it. Unscientific lubrication is responsible for the loss of many thousand horsepower annually in the United States. The magnitude of the proposition is staggering when considered on a national basis. Even in the smallest of shops unscientific or careless lubrication will be responsible for a serious loss of power that could otherwise be rendered useful in performing work.

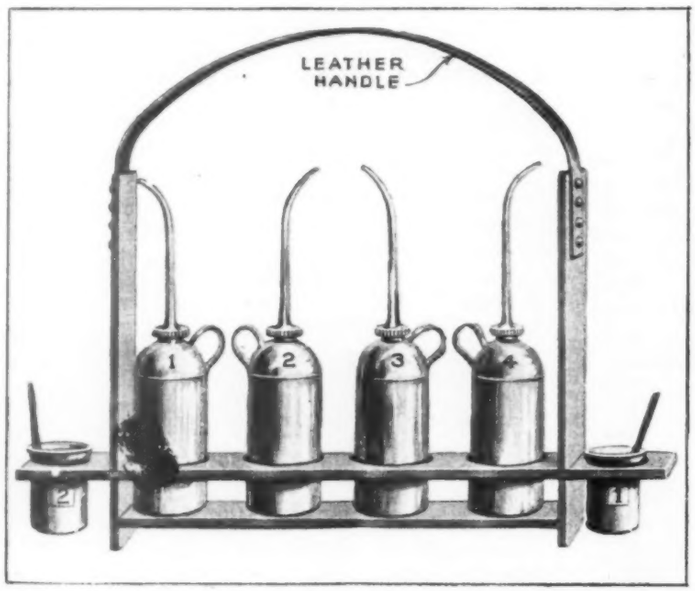
A shop can be lubricated scientifically just as easily as it can be lubricated carelessly. Needless to say, the careless method is by far the most expensive, and the writer is of the opinion that the average small shop, using upwards of 100 horsepower, actually loses between 5 and 15 horsepower through the careless or ignorant use of lubricating oils. The author has in mind a shop which required 37 horsepower to operate it before the importance of the lubricating problem was recognized by the superintendent. Upon the introduction of scientific lubrication the power consumption was reduced to 28 horsepower. It does not require much imagination to see just what the management of this particular shop saved in dollars and cents per year after the haphazard method of applying lubricating oil was discontinued in favor of a more sane and practical method.

In the following paragraphs the writer will endeavor to analyze the lubricating problem, and the data contained therein will be sufficient for the use of those who wish to apply the method.

The first step toward scientific lubrication is the classification of the bearings on all machinery in the shop. All bearings should be classified as follows: (1) High-speed high-pressure bearings, (2) Medium-speed medium-pressure bearings, (3) High-speed low-pressure bearings (4) Special bearings. A special lubricating oil will be needed for each one of these classes. In the average shop the same oil that is employed to lubricate a large boring mill is also used to lubricate a sensitive bench drill. In other words, there is a universal application of one single grade of oil throughout the shop. Nothing could be more impractical or unscientific than this. A lubricating oil with sufficient viscosity for use on a huge boring mill could by no means be successfully employed on a piece of small machinery, with its moving parts revolving at high speed. The same oil that is used on the bearing of a 9-inch lathe should not be used to lubricate the bearings in the shaft hangers When a lubricating oil is too viscid it actually retards the motion although it lubricates the moving parts. On the other hand, an oil that does not possess sufficient viscosity (usually termed a "thin" oil) is unable to withstand high pressure, and poor lubrication will result owing to the fact that the oil will be squeezed out of the bearings. These few facts will illustrate the impossibility of using one oil throughout the entire shop without a serious loss of power and the general efficiency of the machines.

For high-speed high-pressure bearings, a less viscid oil should be employed, and a still lighter oil should be used on the high speed low pressure bearings. The grade of lubricating oil to use on special bearings will be determined by the nature of the bearings. They will be different in different shops. For instance, bearings operating under excessive heat or cold will require a special lubricating oil to obtain maximum efficiency. If the bearing operates under excessive heat, an oil little affected by high temperature must be used. On the other hand a bearing operating where it is cold will need an oil which congeals at very low temperature. There are many other cases where special bearings are used which form a lubricating problem of their own.

Fig.1 shows a small oil and grease holder which can advantageously be used by the shop worker whose duty it is to take care of the lubrication. Each can has a different grade of oil in it and each oil is intended for one class of bearings. For simplicity, and to prevent the use of the wrong oil, each can should have a mark upon it. It is well to mark them, 1,2,3,4, starting at 1 for the light oil and running to 4 for the heavy oil. The barrels in the store room containing the oil supply should be marked in a similar manner and in this way it will be practically impossible to make a mistake. It will be noticed that provision is made at the end of the rack for two small grease cans.




A SHOP APPLIANCE THAT WILL ENSURE EACH MACHINE'S GETTING THE OIL THAT IT OUGHT TO GET

The oiler in the shop should be educated to the proper use and application of the lubricating oil. If the man is impressed with the importance of his task and made to realize that his work is just as essential as any other, he will exercise more care and manifest more interest in his work than he would otherwise. He can easily be made to appreciate the value and necessity of scientific lubrication and thereafter he will lend his aid in systematizing the lubrication of the shop. This is especially true of an intelligent and ambitious young man if he is given enough freedom to exercise his initiative.

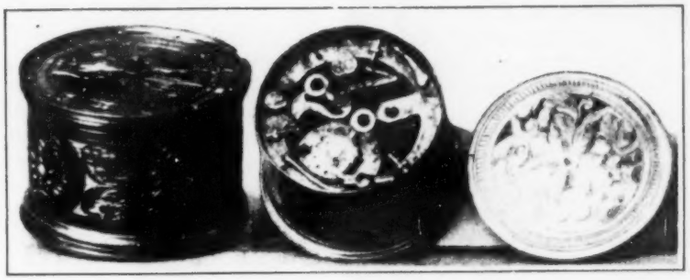
Grease-lubricated bearings should be classified in the same manner as oil-lubricated bearings. However, it will be found that there are seldom more than two grades of grease necessary. Sliding surfaces should be classified according to velocity and weight in the same manner as revolving surfaces.

(Continued on page 494)

## A WATCH FROM THE SIXTEENTH CENTURY

The earliest attempt to manufacture a timepiece that could be carried on the person is believed to have been made in Germany toward the close of the fifteenth century. Certainly, if isolated watches were made earlier and elsewhere, it was at this time and place that their continuous evolution had its beginnings.

The watches of this early period were crude enough. The problem of increasing tension on the mainspring as it runs down had not as yet been solved; so it was necessary to wind the watch more frequently, in order to maintain good time, than the period of its mainspring would have required on other grounds.



A WATCH FROM THE SIXTEENTH CENTURY, RECENTLY FOUND IN NUREMBERG, AND BELIEVED TO BE THE OLDEST IN EXISTENCE

For another thing, there was seldom made any effort to produce these early watches in real pocket size. The sixteenth century watch was not a watch at all, in the sense of a pocket timepiece; it was so heavy and bulky that ordinarily it had to be carried on a strap, suspended on the girdle. The picture in fact conveys a good idea of the bulk of the average specimen.

According to well authenticated records turned up recently in Nuremberg, together with this watch, the instrument appears to be the oldest extant sample of the watchmaker's art. It was made in the city named in the early part of the sixteenth century. The works are altogether of iron; of the same material is the mainspring, with an auxiliary spring in the form of a pig's bristle, designed to perform the regulatory function the necessity of which was brought out above. The second-hand was still far in the future when this timepiece was made, so it has but the hour and minute hands. Perhaps the most emphatic difference from the modern ideal which it exhibits, however, is its extreme thickness. The wafer as model for a watch was far beyond the ability of the mediaeval artisan; he had not learned how to arrange the works of a timepiece practically in a single plane.

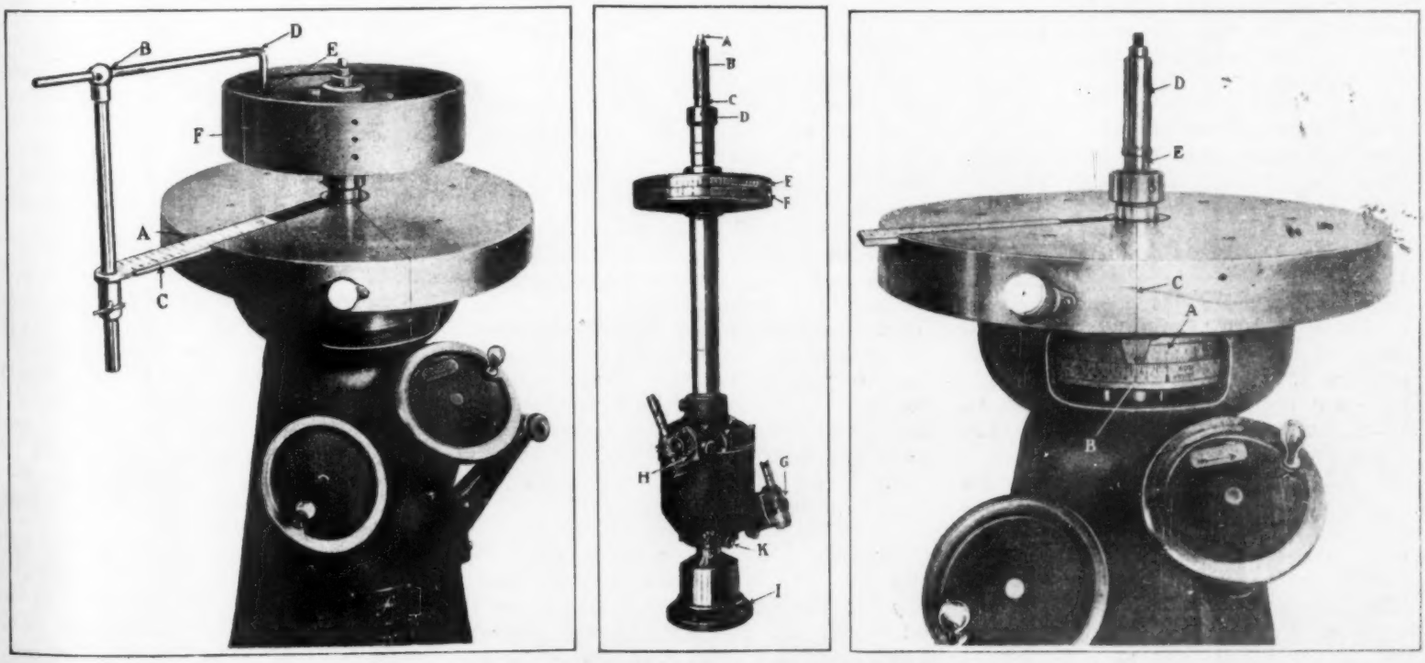
## CORRECTING THE BALANCE OF REVOLVING PARTS

The layman hardly realizes the importance of perfect balance in the rotating members of a machine. Unless perfect balance is present, vibration results. This means loss of power and may also result in serious strains to the part itself, or to associated parts, which in time will be disastrous to the machine. It is accordingly highly essential that all members which are to revolve at high speeds be very accurately tested for balance. A slight irregularity in a casting may well be enough to produce serious consequences.

In order to test revolving parts a number of ingenious mechanisms have been got up We illustrate a balancing machine of particular sensitivity. It will detect an excess of an eighth ounce in a 5-inch radius, with the machine revolving at 900per minute. An indication of the unbalanced body can be had in from 8 to 15 seconds, depending upon the degree of experience and dexterity of the operator. Not only does the machine indicate the place where the part must be counterbalanced, but it shows the amount, in ounces, of the excess or deficiency.

It may be well to explain that certain members, such as pulleys, must have their balance adjusted by addition of counterweights because usually their shells are too thin to permit of removing metal with safety. Flywheels, on the other hand, can be more readily corrected by removing metal from the heavy side.

(Continued on page 490)




THREE VIEWS OF THE BALANCING MACHINE

Left: upper part, with balancing wheels showing through casing. Center: machine removed from casing. Right: radial indicator that shows how much metal must be added or taken off at a given place

# The Service of the Chemist

*A Department Devoted to Progress in the Field of Applied Chemistry*

Conducted by H. E. HOWE, Chemical Engineer

## DETECTING FRAUD

As science advances it becomes ever more difficult successfully to carry out fraud in materials, just as the channels for the escape of criminals of certain classes become smaller and smaller. At intervals attention has been directed to the use of science in these matters. For example, the use of the microscope in detecting mixtures of starches and impurities in spices, the development of chemical methods that indicate illegal preservatices in food or deceit in materials generally, and the comparison microscope for catching forgeries, occur at once. Photomicrography plays a part and the methods for identifying blood have often decided cases. All systems for recording criminals have strong scientific foundations.

To be sure there are careful scientists at work on both sides, especially where materials are concerned. One group strives to discover ways of introducing undesirable substances in a manner that shall defy detection, the other works out means of accurate analysis. Since soya-beans and soya-bean oil came in the market, there has been a temptation to mix this substance with linseed oil. The objection to the bean oil is that it does not dry down into a hard film, but into one that is too soft to prevent its catching dust and dirt, thereby detracting greatly from the appearance of the surfaces to which it is applied. To identify oils the constants usually determined are specific gravity, saponification value, and the iodine number. For linseed oil these are, respectively, .932-.936, 189-195, and 170-190. The corresponding soya-bean constants are .920-.930, 180, and 130. Thus the iodine number is the only one markedly different, and yet a simple calculation reveals that 30 per cent of soya-bean oil may be in mixture with 70 per cent of linseed oil, and the mixture will have an iodine number falling within the limits permitted for lisneed oils.

To this state of affairs the Bureau of Standards has directed its attention, with the result that a new method has been discovered by Messrs. Steele and Washburn, that holds considerable promise. When bromine is is added to this sort of mixture under proper conditions an additional product is formed; and the amount of this purified hexabromide obtained is a constant which thus far has always fallen between 45.6 and 46.9 for oils with iodine numbers between 177 and 191. The figure for soya-bean oil, however, averages 2.2 with a maximum of 5. On the basis of the difference here shown, as little as five per cent of the soya-bean dilutant can be detected; the method has led to good results even in the case of unskilled operators, while those skilled in its use have checked its findings with great accuracy. The present effort is to place limits within which pure linseed oil and a soya-bean product may fall. After this the extent to which the amount of either oil in the presence of the other is determinable will be known.

## COOPERATION TO IMPROVE AMERICAN APPARATUS

Those who still long for apparatus or reagents "Made in Germany" will not rejoice in the steps being taken to strengthen the position of American-made materials in this country, but there are many more who are eager to cooperate in any work directed toward improvement. German apparatus was not always conspicuous for uniformity in quality and dimensions and often reagents fell short of the required purity. On the other hand, long practice in a specialty results in a form, a finish, and dimensions to which we grow accustomed; and in the emergency to produce what was required, some of our American manufacturers neglected some of these fine points, notably uniformity of design and dimension. We have suffered from tubes, stems and necks of varying length and diameter and complaints there have been of undue inaccuracy in capacity and faulty annealing. Certainly we should be able to avoid unnecessary varieties in shape and size, to the encouragement of quantity production.

Let it beemphasized that the quality of American scientific glass is in every respect highly satisfactory and even superior to that previously imported; and that the reagents made here are much better than many have supposed. Of whatever objection be made to these reagents, a bit more careful supervision in the manufacture would dispose completely.

In all this we may see an opportunity for service which the Committee on Standardized Reagents and Apparatus of the American Chemical Society is prepared to render. The chemical manufacturers are eager to cooperate when they know what specifications to follow and what methods of testing to look for. Therefore users are being asked to submit an outline of requirements and of the tests applied by them to determine the presence and the amount of objectionable impurities. These data will be examined by the Committee and those cooperating with it, resulting in a set of standard sepcifications covering a certain line of sulfuric, nitric or hydrochloric acids, and ammonia. Full data is also sought regarding apparatus, and when in the proper form this will be available for the guidance of our progressive scientific glassmakers.

## INTERESTING PRICE STUDIES

The Superintendent of Documents, in the Government Printing Office, Washington, is prepared to supply copies of some 57 bulletins on the prices of commodities. Many of these lists are of interest to the chemist. The data was compiled originally by the War Industries Board, for military purposes, the work being done in the Division of Planning and Statistics. The bulletins were prepared by those having particular knowledge of the various fields rather than by economists only.

Fifty of the bulletins are divided into seven major groups - food; clothing; rubber; paper and fibers; metals; building materials; fuels; and chemicals. There are four special bulletins upon the prices of foods, clothing, building materials, and chemicals; and the remaining three comprise a summary in which the methods employed in the work are set forth, and the results are brought together for comparison and comment

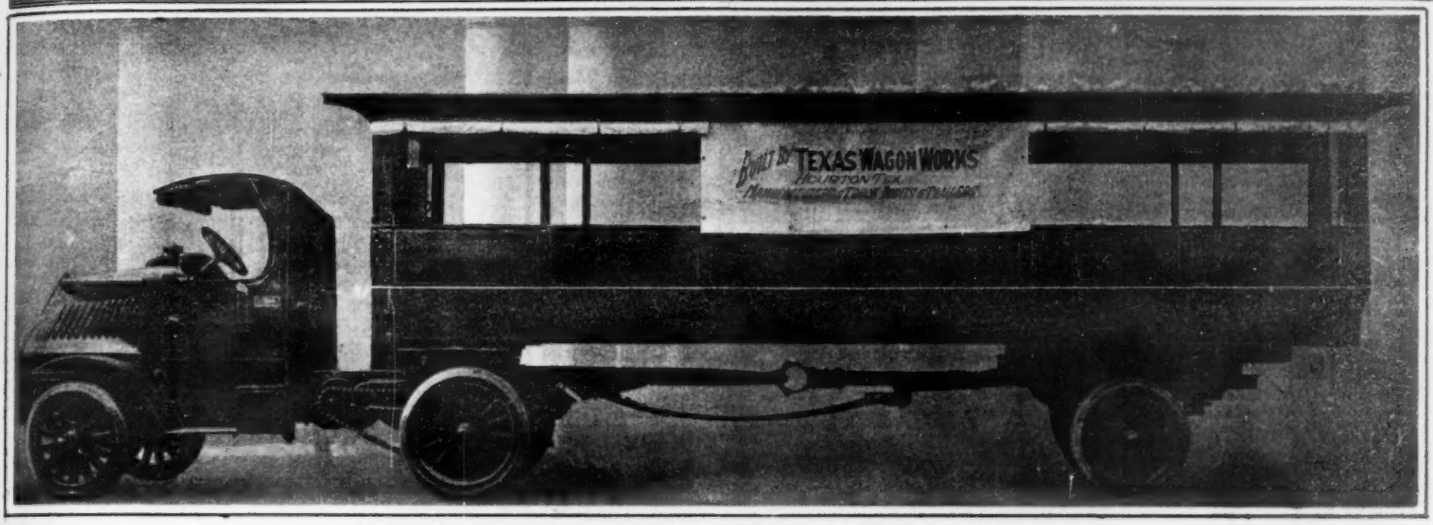
The chemical group gives a place to the following subjects: mineral acids; heavy chemicals; miscellaneous inorganic chemicals;fertilizers; soaps and glycerin; essential oils; flavoring and perfumery materials; wood-distillation products and naval stores; natural dyestuffs and tanning chemicals; coal-tar crudes, intermediates and dyes; drugs and pharmaceuticals; proprietary preparations; explosives; and miscellaneous organic chemicals.

The purpose of this work was to afford a record of the great price revolution accompanying the war and to make reliable date available to persons concerned with the complex and vital problems of business readjustment.

# The Motor-Driven Commercial Vehicle

Conducted by MAJOR VICTOR W. PAGÉ, M. S. A. E.

*This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles*




PASSENGER BUS THAT TAKES EIGHTY MEN TO WORK AT MORGAN, LA.

## EIGHTY-PASSENGER TRAILER BUS

Future possible development of passenger transportation for communities not adequately served by rail is suggested by the trailer bus shown herewith. This equipment was designed to meet the requirements of a large oil company in transporting its employees to its works in Morgan, La. It measures 25 feet in length, 8 in width and 6 in height. The interior has four longitudinal seats.

The trailer is drawn by a short-wheel-base truck tractor. The rear wheels and axles turn under the body like the front wheels of a wagon, and are connected under the center of the body through a universal joint with a pole from the tractor so that the trailer wheels track with the rear wheels of the tractor. This permits the outfit to make short turns without cutting corners.

The rear end of the tractor is fitted with a tilting fifth wheel that carries the front end of the body. Swinging bolsters support the body near its two ends. Draft or pull of the tractor is through two chains fastened to the side members of the tractor frame, and to the pole underthebus.

USING A TRACTOR TO PULL OIL-WELL CASINGS

ROUGH GOING IN THE POCONOS, BUT THE TRACTOR MAKES IT

## TRACTOR IN OIL-FIELD WORK

Our illustration shows a relatively new application for the gasoline horse. In hauling machinery and other supplies from railroad to field extra handling at the end is eliminated. Tracklayers are also being used in such work, and for pullingwell casings, hauling rigs and other machinery from place to place, and hauling lumber for the derricks. Such outfits can of course be used at points where wheeled vehicles could not get traction.

## UNUSUAL ROAD CONDITIONS

On top of Mt, Pocono, Pa., the Government is storing millions of pounds of TNT, against the emergency when some aggressive nation may take liberties with us..The explosive is brought to Tobyhana by rail and hauled 12 miles back to the magazines. For this work forty four-wheel-drive trucks and fifteen caterpillar tractors are used. The roads, of which our photograph gives a representative section, are said to be so bad that a set of solid tires lasts only 1,000 miles.

There surely can be no question as to the merits of the tractive system that is able to surmount such obstacles.

# The Electric Ship!

ELECTRIC drive for great ships became a fact with the successful trials of the New Mexico, flagship of the Pacific Fleet, the first battleship to be propelled by electricity.

"This engineering feat," says Secretary Daniels, "holds a peculiar interest to the people of the nation, especially when they realize that in this achievement the American Navy stands pre-eminent among the nations of the world. It marks an epoch in naval progress." It is another great advance in the mastery of the sea.

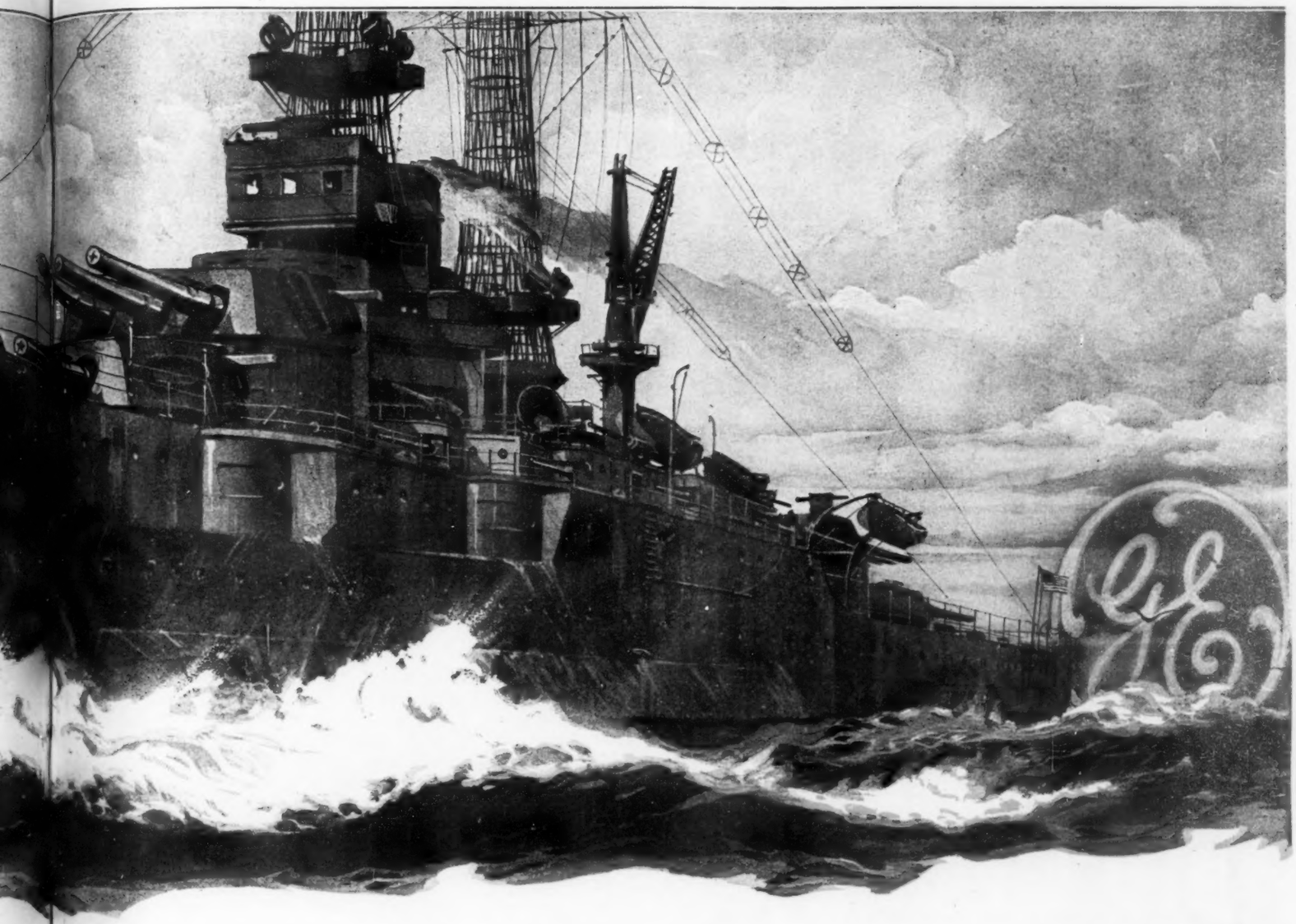
Ten years ago electric propulsion for vessels was being discussed by eminent engineers. But it remained for W. L. R. Emmet, consulting engineer of the General Electric Company, in co-operation with the Bureau of Steam Engineering, U. S. Navy, to apply it to large ships.

Five years ago electric drive was installed on the collier Jupiter, while one of her sister ships was equipped with geared steam turbine drive and another with direct-connected reciprocating engines. The results proved the unquestionable superiority of electric drive.

And so electric drive was adopted for the super-dreadnaught New Mexico, with 32,000 tons displacement and a speed of 21 knots. Steam from her oil-burning boilers drives two Curtis turbo-generators, which generate electric current and feed it through a central control to four 7,000 horse-power motors, each coupled to a propeller. Two thousand additional horse-power is generated for lighting, steering, turret machinery, ventilation, winches, windlasses, cranes, radio, telephony, searchlights, laundry, refrigeration, baking,

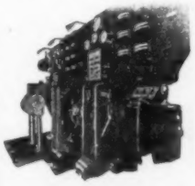
One of the four G-E 7,000 horsepower electric motors—each on the end of a propeller shaft. They drive the New Mexico up to 21 knots, and can be reversed to full speed astern in thirty seconds.

GENERAL



machine shop — making the New Mexico an electric ship indeed!

As a result of the performance of the Jupiter and the New Mexico the United States Navy has adopted electric drive for all its capital ships now under construction or which have been authorized.



The operator of this control board — in the center of the ship — controls, through a few levers, the speed and power of the turbo-generators and propelling motors, in immediate response to telegraphic orders from the bridge.

Its success in the Navy forecasts the rapid adoption of electric drive for merchant ships. In the case of any large ship now operating with reciprocating engines on long voyages, electric propulsion, if substituted, would afford enough improvement to pay for itself in three years.

Admiral Benson, until recently Chief of Naval Operations, says, " . . . as soon as the merits of this system become known commercially electric propulsion will prove its practical value in the Merchant Marine just as thoroughly as it has to the Navy." He states that he regards " . . . electricity as the most economical motive power, from every viewpoint, so far developed for large units."

The chief advantages of electric drive are:

1. *Economy* — Fuel economy is not only apparent in the operation of electrically propelled ships, but decreased fuel storage room makes way for valuable cargo space.

Two of these 14,000 horsepower Curtis turbo-generators, singly or together, produce current for any or all of the four motors.

2. *Reliability*—Electric propelling machinery has no motion other than simple rotation. Its simplicity in transmitting power from turbine to propeller eliminates the trouble caused by large reciprocating parts or multiplicity of reduction gears.

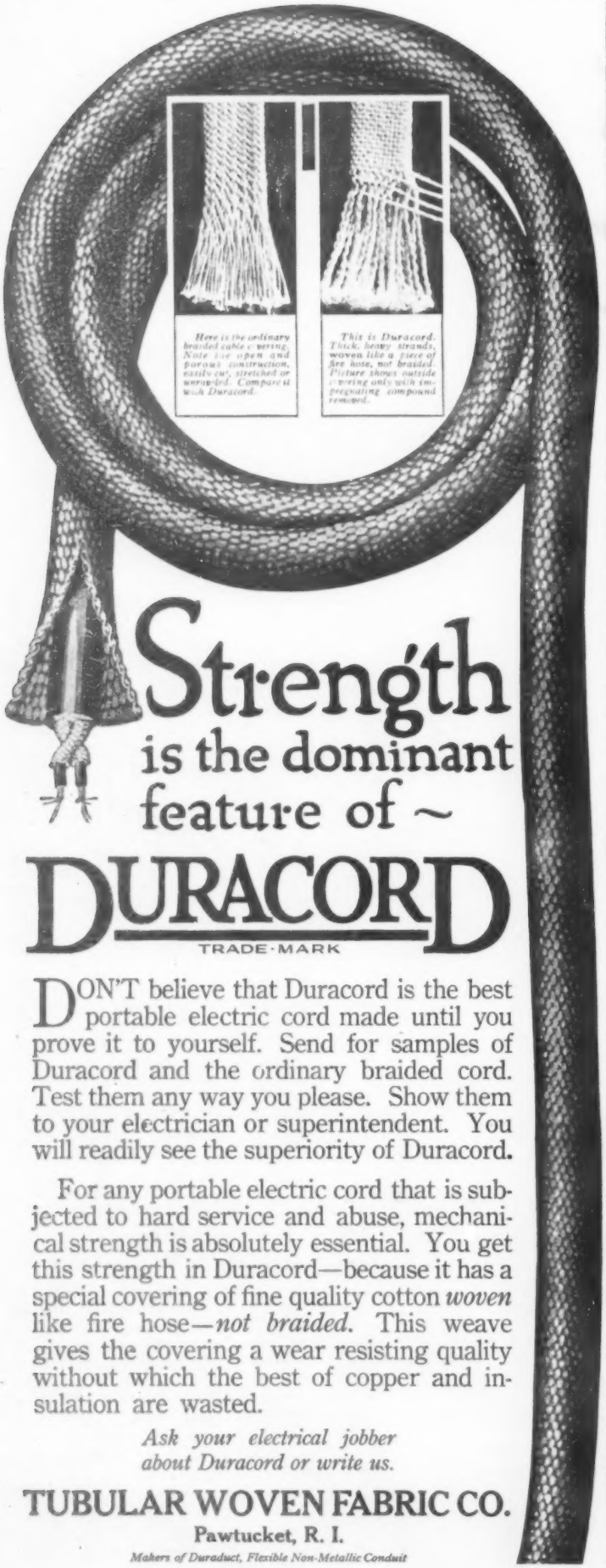
3. *Flexibility of Installation* — Electric motors may be placed in the stern, instead of amidships, greatly reducing the length of propeller shafts and shaft alleys. The turbines can be near the boilers in compact quarters, doing away with many feet of steam piping, and adding valuable space. The power is transmitted the electric way — through small cables. The control can be in any convenient place, even on the bridge.

4. *Safety* — Electric drive gives vastly greater safety than the old types, because each can be isolated in its own water-tight compartment. In collision or other accident the throwing of a switch disconnects a damaged motor or shaft, and in the case of more than one propeller, the power is transmitted to the remaining propellers.

The building of electric propulsion machinery for ships of the Navy and Merchant Marine is but one of the many activities of the General Electric Company in its service to the Government, to transportation, to industries, to science, to cities and to the home. An illustrated booklet describing the New Mexico, entitled, "The Electric Ship" will be sent upon request. Address General Electric Company, Desk 66, Schenectady, New York.

95-160

E L E C T R I C


Here is the ordinary braided cable covering. Note its open and porous construction, easily cut, stretched or unraveled. Compare it with Duracord.
This is Duracord. Thick, heavy strands, woven like a piece of fire hose, not braided. Picture shows outside covering only, with impregnating compound removed.

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For any portable electric cord that is subjected to hard service and abuse, mechanical strength is absolutely essential. You get this strength in Duracord—because it has a special covering of fine quality cotton *woven* like fire hose—*not braided.* This weave gives the covering a wear resisting quality without which the best of copper and insulation are wasted.

*Ask your electrical jobber about Duracord or write us.*

**TUBULAR WOVEN FABRIC CO.**

Pawtucket, R. I.

*Makers of Duraduct, Flexible Non-Metallic Conduit*

## CORRECTING THE BALANCE OF REVOLVING PARTS

(Continued from page 485)

In the illustration showing the machine removed from its casing, there is seen a vertical shaft in which is placed a tapered plug-spindle C; and on this is fitted a sleeve B which may be expanded by the screw A. On this sleeve B is mounted the pulley, flywheel or other member whose balance is to be tested. The tapered spindle C is held in place in the shaft by means of the nut D. The shaft carries two balance wheels E and F which are eccentrically weighted. These are movable with respect to each other by means of the gears G and H, and they may be turned until one exactly counterbalances the other, when an arrow on the wheel F will be in line with the word "balance" on the wheel E.

In use the part to be tested is mounted on the sleeve B and the balancing machine is revolved. Above the balance wheels the casing carries a stationary circular table, shown in our left and right hand views. On this may be seen an indicator dial, with a hand which remains at zero when the revolving parts are in balance. In the right hand view we have a flywheel under test on the spindle of the machine. When the machine is rotated, if the flywheel is unbalanced, it will produce vibrations that will cause the needle of the indicator to vibrate. By turning the hand wheels, the balancewheels E and F may be moved in either direction until they counterbalance the unbalanced weight in the piece under test. The indicator hand will obviously tell us which wheel to operate.

Testing proceeds until vibration ceases and the indicator hand therefore comes to rest at zero position. Then the machine is stopped and a reading is taken of the graduations on the two balance wheels which show through the opening in ourfirst view. As this is a flywheel which is under test, the balance must be restored by removing metal. Accordingly the flywheel is turned until an arrow on the upper balance wheel registers with the line shown at C. This will give a reading on the lower balance wheel F directly under the arrow. In order to determine just how much metal should be removed at any given place, there must be marked on the flywheel a chalk line in register with the line C. This is indicated at F in the third view. The radius plate A is adapted to slide in a radial slot in the table which carries the indicator. This plate carries a vertical shaft B and an indicator rod D bent at one end and terminating in a point E. The pulley under test is turned until the chalk mark F is in line with the indicator rod D. Then the radius plate is moved in or out until the point E is in line with the place on the flywheel from which it is desired to remove the metal. A reading is taken on the radius plate where it registers with the edge of the table and then by means of a chart which is supplied with the machine, together with the reading on the balance wheel F, there is shown just the number and depths of the holes necessary to remove the required amount of material at the place indicated by the pointer.

This balancing machine will take bodies from 4 to 36 inches in diameter, and will support weights as heavy as 600 pounds, revolving at 500 per minute. The speed range of the machine is from 250 to 900 revolutions per minute.

## ETERNAL YOUTH AS A SCIENTIFIC THEORY

(Continued from page 482)

the exception of the brain. Parr has his niche in Westminster Abbey.

On the other hand, Metchnikoff's description of a lady of 106 is to the effect that though feeble in a physic-

(Continued on page 500)

THE man who tempers a BILLINGS & SPENCER die performs a task of infinite delicacy. He builds high character into steel. His craft goes beyond mere knowledge—it is work no machine can perform, no instrument gauge. The rightness of the Triangle B die passes inevitably to the Triangle B forging. In steel, as in men, character begets character.

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POWRLOK PREVENTS
STALLING & SKIDDING

THE STORY OF NICKEL

(Continued from page 480)

from the same source runs as high as 59.69 per cent. The Esquimos have made good use of this iron, hammering out tools of it from the large masses left after the weathering of the parent rock.

Alloyed with copper, nickel finds many uses. Monel metal, an alloy of 67 per cent nickel with 28 per cent copper and about 5 per cent manganese and iron, is used where high tensile strength and resistance to corrosion are desired. During 1908 about 300,000 square feet of monel-metal sheets were used to roof the Pennsylvania tunnel station in New York. This alloy when new is silver white and takes a brilliant polish, slowly turning grayish on exposure. Monel metal melts at 1350° centigrade, has the same specific gravity as copper, and is distinctly stronger than ordinary steel or manganese bronze.

Cupro-nickel is an alloy of about 20 per cent nickel and 80 per cent copper. It is largely used in the manufacture of bullet jackets and other munitions of war. This use of the alloy gives to the rifle bullet a surface that will resist destruction by the rifling of the barrel.

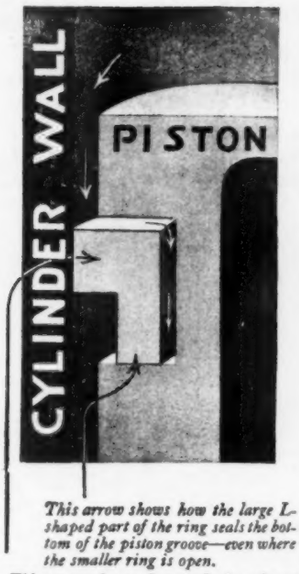
Nickel silver, in former years German silver, contains from 12 to 25 per cent nickel alloyed with copper and zinc. Its uses are too well known to need description and range from tableware and railway coach fittings to electrical resistance wire. The use of German silver for this latter purpose has somewhat diminished owing to the superior qualities of other nickel alloys. Nickel and chromium or manganese alloyed and worked into wire make the most valuable of resistance media for electrical heating appliances and the chromium alloy moulded into other shapes finds many commercial uses where high temperatures are met and severe oxidation has to be defeated.

Liquid fats and oils are largely composed of oleic acid and it has long been known that these can be converted into the hard fat stearic acid by the introduction of hydrogen into the molecule. This is accomplished by heating the oil in an atmosphere of hydrogen and in the presence of a catalyist. Metals of the platinum group had long been employed for this purpose but the practical importance of the process in the making of domestic shortenings and soaps arose through the discovery that nickel in a finely divided state made a catalyist at once cheap and efficient. The softer products of hydrogenation resemble lard in appearance while those made from whale oil can scarcely be distinguished from mutton tallow in taste, appearance, or smell.

Next to the Sudbury region, the French colony of New Caledonia, 900 miles east of Australis, is the most important source of nickel. The metal was discovered in 1865 by Garnier and the first shipment of ore was made to France sometime after. Deposits of nickel are found in large beds on gentle slopes or basins on the flanks of mountains; the nickel occurring as a hydrated silicate in which the nickel has replaced magnesia to a greater or less extent. The richest silicates, which are green and soft, may contain up to 48.6 per cent of nickel oxide but their composition varies greatly. It is interesting to note that the New Caledonia ores practically never contain sulphur, being silicates accumulated in beds through the weathering of the original rock, while the nickel deposits of Sudbury are in the form of sulphides associated with those of iron and copper.

Sixty years ago, Northern Ontario, then a part of what was known as Upper Canada, was a wilderness with its resources untouched and unknown. The first intimation

(Continued on page 496




*This arrow shows how the large L-shaped part of the ring seals the bottom of the piston groove—even where the smaller ring is open.*

*This arrow shows where the L-shaped part of the ring seals the wall of the cylinder.*

*This arrow shows how the smaller ring seals the bottom of the groove—even where the large L-shaped ring is open.*

*This arrow shows how the smaller ring seals the cylinder wall—even where large L-shaped ring is open.*

*This cut shows how both the wall of cylinder and the groove of the piston are doubly sealed where there are no openings in either of the two component parts of Double Seal Rings.*

# Dr. Kibbie and His Automobile

**It wasn't living up to the fine reputation of its kind**—that automobile of Dr. Kibbie's. It wouldn't climb anything around Fort Worth except on low. Its gasoline record looked as if there were a leak in the gas tank. Its oil bill was a caution. He did what anybody would do under the circumstances; he had the valves ground, the cylinders cleaned, and the motor tuned. But things didn't change much.

**Right after a big automobile race** in Texas he heard from an engineer friend that five of the winners used Double Seal Piston Rings to increase compression power and speed. Dr. Kibbie thought he'd try them. He had his car overhauled again and the Double Seal Piston Rings put on every piston. The first time he took that automobile out he was surprised.

**It certainly took the hills on high;** and when the gas and oil mileages were checked up they proved to be twice as much per gallon as ever before. Of course the doctor couldn't quite believe that it would last.

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**Thousands of other car owners say similar** things about Double Seal Rings. Some of them had Double Seals put into old cars whose cylinders were worn, others into new cars whose motors somehow weren't just right, others had engines that "killed" annoyingly, others just had the usual trouble of too much carbon and too few miles per gallon.

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## THE SHOP LUBRICATION PROBLEM

(Continued from page 484)

The oiler should also know how to care properly for injured bearings. Although this is important, little trouble will be experienced from this source if the stop is lubricated properly, as in this event few overheated bearings will result.

A few minutes consideration may well be given to the real nature of friction. This will give us a greater insight into the problem just considered. To make the relation between friction and lubrication clear, we will imagine a body at rest upon an inclined plane The angle of the plane upon which the body is resting is such that the static friction (friction of rest) will prevent the body from sliding down. It will be understood that the friction between the body and the plane will depend upon three factors; the weight or pressure of the body, the angle of the inclined plane and the condition of the surfaces. If a lubricating oil of the proper viscosity is placed between the plane and the body it will be found that the body will gain motion. If the lubricating oil introduced between the surfaces is too viscid, the motion will be greatly reduced and if an ultra-viscid oil is used, the motion will be entirely arrested. In fact, the oil acts as a glue, thereby proving that a lubricating oil is not necessarily a lubricant under all conditions.

Before the lubricating oil was introduced between the plane and the body the infinitesimal depressions in the surface of the body and the plane interlocked with one another. The resulting friction entirely overcomes gravitational force that would otherwise cause the body to gain motion. The introduction of a lubricant between the contacting surfaces of the plane and the body entirely separates them and the friction is no longer between these two surfaces but between the surface of the lubricating

(Continued on page 498)

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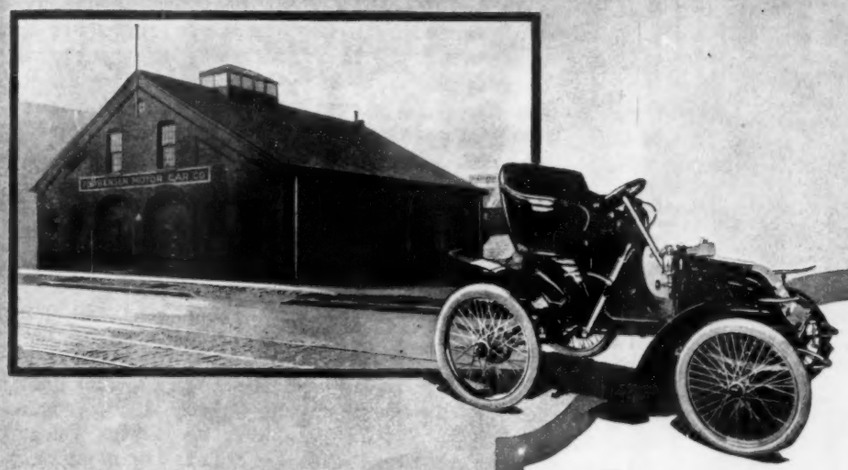

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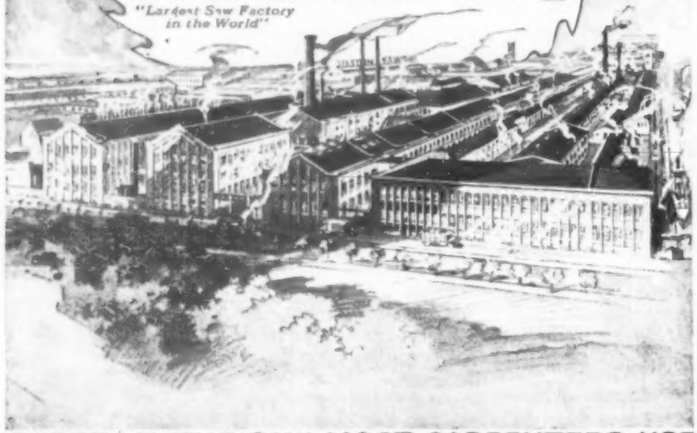

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## THE STORY OF NICKEL

(Continued from page 492)

that valuable ore deposits might be found at the head of Lake Huron was made in 1848 in a report by Sir William Logan, then provincial geologist, who mentioned that in one instance copper pyrites was accompanied by compounds of iron and nickel, with a trace of cobalt. Nickel was first reported from this region by Murray in 1856. A well known land surveyor, Salter, noted indications of iron near the present Creighton mine, his compass needle being deflected by the iron with which the nickel is associated in the ore. It was at his suggestion that Murray investigated the deposit, finding iron, copper and nickel.

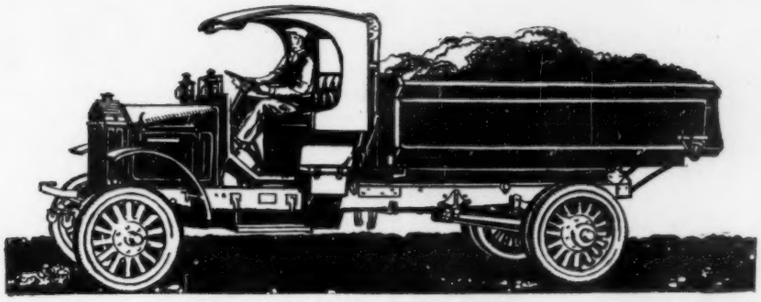
The running of the Canadian Pacific Railway through this district in 1883 effected the discovery of important nickel deposits, as in the making of a cutting the excavation was carried through the body of what was of what was afterwards known as the Murray mine. This exposure gave the public some inkling as to the value of the minerals to be found and the country was quickly prospected, most of the important deposits of nickel and copper ores being found in a comparatively short time. The nickel region has sharply defined boundaries of a geological nature since all the ore deposits are connected with a great sheet of eruptive rock, roughly boat shaped. Only the upturned edges of the sheet are exposed since it is basin shaped and has its interior filled with sedimentary rock. The basin is about thirty-six miles long and sicteen miles wide, the known ore deposits occurring along the edge of the sheet or less than four miles away from it on projections or offsets. The Sudbury ores contain essentially only four ingredients, a magnetic sulphide of iron which is practically free from copper and nickel, a sulphide of nickel and iron, a sulphide which contains equal parts of iron and copper, and a variable amount of rock matter of various kinds.

In the preparation of the ores from the various mines of the Sudbury district, the processes followed by the various companies are much alike up to the point where the separation of the copper and nickel commences. The first step is the roasting of the ores to rid them of excess sulphur. In former years and at the present time much of this roasting has been performed in the open, but it is expected that this necessarily wasteful practice will be done away with and other processes used that will conserve the sulphur and result to the advantage of the surrounding vegetation.

After roasting, the ore is smelted to smelted to standard matter in water-jacketed blast furnaces, similar to copper blast furnaces. These are rectangular in shape, and some of them can handle up to about 500 tons of ore a day. Ores can usually be blended so as to form almost self-fluxing mixtures; but quartz is added as required to produce a further oxidization of the iron and sulphur, and limestone may be added to increase the fluidity of the slag. The smelting consists of two products, matte and slag, both of which are run into settling basins where they separate more completely. As a result of the smelting the quartz, clay, lime and magnesium oxide pass into the slag, while the matte contains nearly all the nickel and copper with much of the iron and sulphur of the original charge.

The liquid matte from the settling tanks is passed into Bessemer convertors where the iron is oxidized in much the same manner as is the carbon in the familiar Bessemer convertor of the steel mill. The iron passes out in the slag resulting from the operation and a standard matte ready for refining results. This matte contains very nearly all the nickel and copper, very little of the iron and a high percentage of sulphur.

(Continued on page 502)



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Scientific American Publishing Co. Woolworth Building, New York City


### THE SHOP LUBRICATION PROBLEM

(Continued from page 494)

oil and the plane and the surface of the lubricating oil and the body. Whether or not the oil that was introduced between the surfaces was too viscid would depend entirely upon the weight and pressure of the body. If the body was light a very "light" or "thin" oil could be employed. For a given weight of the body it will be found necessary to use a lubricant with specific characteristics in order to obtain maximum efficiency. The more closely these conditions are approached in the shop, the less the waste of power will be. Considering the importance of the problem and the easy way in which it can be solved, every manufacturer is doing himself an injustice by not lubricating his machinery according to scientific standards.

### BOOSTING THE CEILING OF THE AIRPLANE

(Continued from page 481)

ing about 100 pounds, consisting of a gas turbine and a centrifugal compressor. The former derives its power from the hot exhaust gases of the engine, and uses it to drive the compressor at about 22,000 revolutions per minute. The air taken in and compressed by the compressor is fed to the carburetor at the same pressure as at sea level. Thus the engine maintains its normal power output even at high altitudes, where the air contains but 50 per cent as much oxygen as at the base level.

Heretofore all engines at 8000 feet have suffered a loss of about 50 per cent, in the power delivered, owing to lack of oxygen. At 25,000 feet they lose about 75 per cent.

The inventors were obliged to carry on their research work at the summit of Pike's Peak where they experienced all the rigors of winter in the summer time. With the summit at 14,100 feet above sea level, they found air conditions and pressure duplicating what the aviator encounters in high flying.


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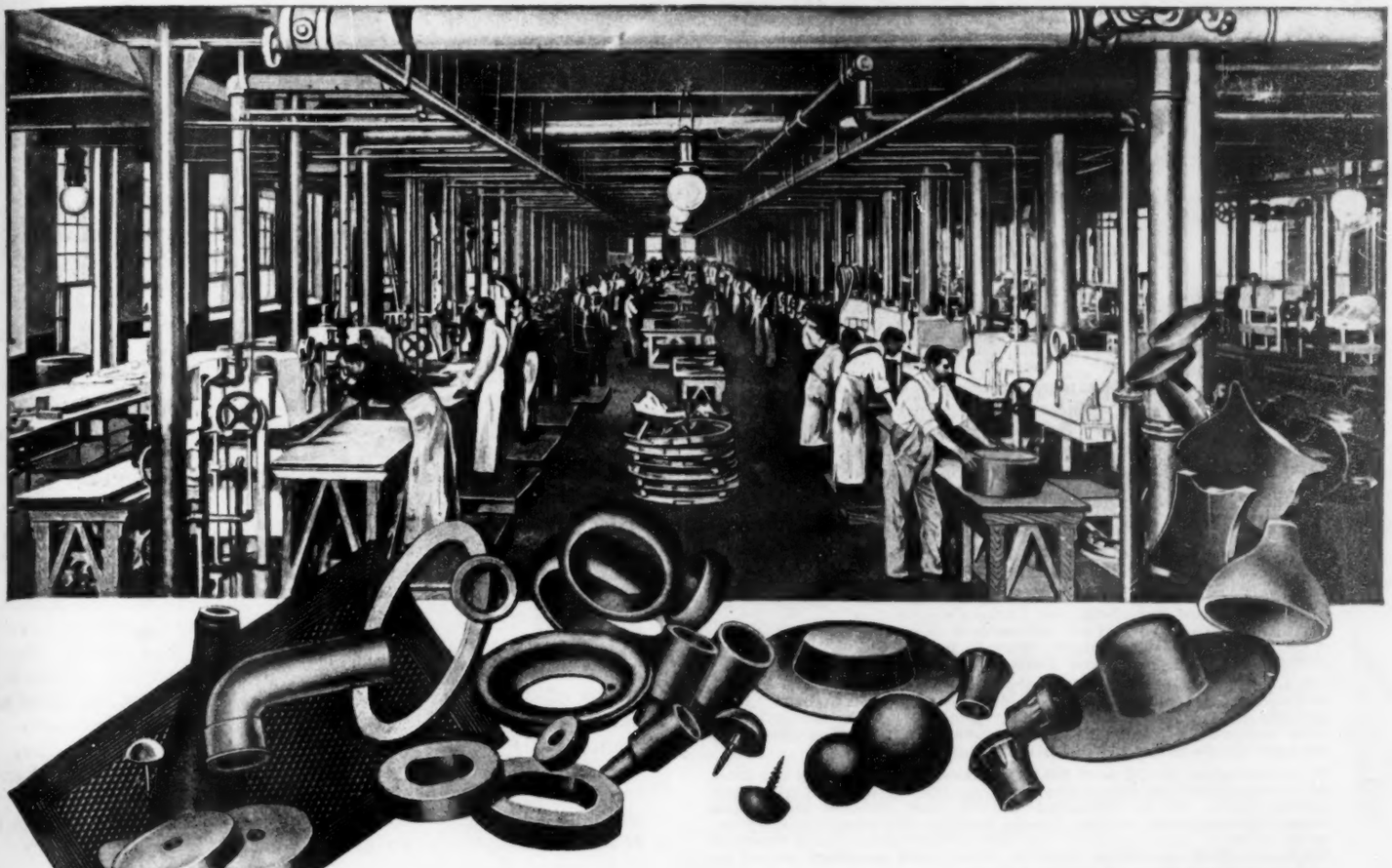

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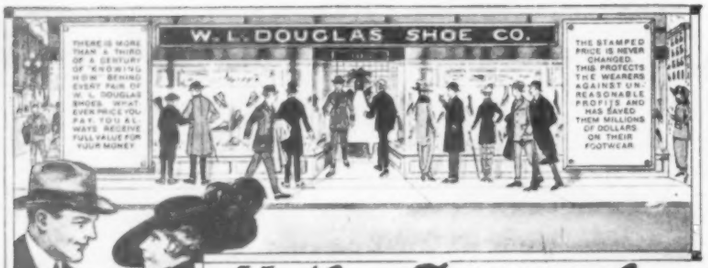


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## ETERNAL YOUTH AS A SCIENTIFIC THEORY

(Continued from page 490)

al sense, she had all her mental faculties and showed no sign of that supposedly invariable accompaniment to - if, indeed, not primary cause of - old age: i. e., hardening of the arteries.

### What Really Causes Decay and Death?

Does anything really explain these astounding differences in the duration of existence? Why do certain species, as a whole, and why do individuals of other species, appear as exceptions to the rule that life is short?

The clue to the mystery is not to be found in the constitution of living matter. Under appropriate conditions the kidney and the liver will function after removal from the dead body. In an artificial circulation established "with warm, defibrinated blood,...the liver will secrete gall and produce urea, while the kidneys will resume the secretion of urine. ... The kidneys continue their synthetical activity by producing hippuric acid out of glycocoll and benzoic acid. These observations are of especial importance with regard to the fact that the synthetical action of the organ requires all the vital properties of the protoplasma of the cell." (Rational Organo-therapy; translated from the Russian of von Poehl, Tarchanoff, etc.)

Hence the "vital qualities" inherent in the physical basis of life may be made active after what we know as personal death. All this is in line with the above-mentioned fact that the primitive cell does not die. Yet if the unit, aggregations of which make up the animal body, is immortal - why should the aggregate be mortal? In other words, if we may put the matter in a somewhat melodramatic guise, can life multiplied by life equal death?

The answer is that though there is nothing in the protozoa, itself, to challenge its capacity to live endlessly, something may be introduced. The immortal may be reduced to mortality by poison, by extreme heat or extreme cold. Though not dying a natural death, the one-celled protozoa may die from secondary, external causes. Is it some such secondary cause, often if not indeed always preventable, which interferes sooner or later with the functioning of the many-celled metazoa?

Metchnikoff, in his Prolongation of Life, has expressed the opinion that "natural death" is exceedingly rare in nature. We have no further space to discuss further his reasons for coming to this conclusion. But obviously the experiments of Voronoff and others, looking toward the elimination of old age, would if successful constitute a long step toward the verification of the great Russian's guess.

## THE NEW WELLAND CANAL

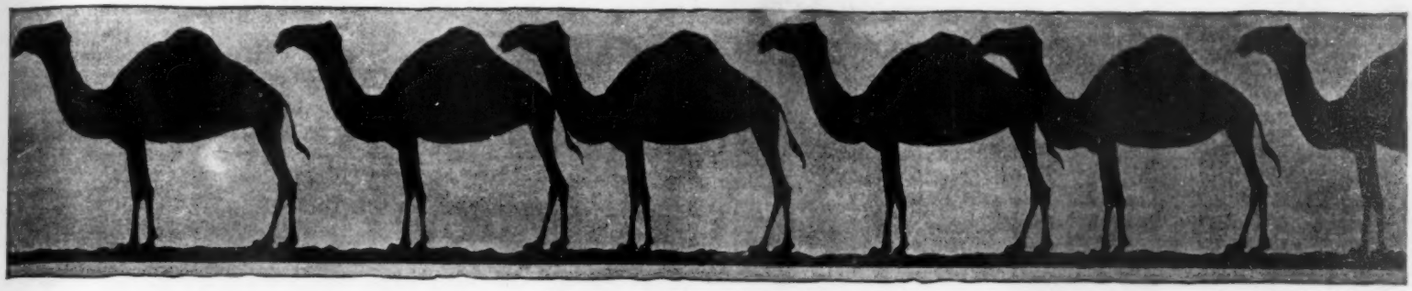
(Continued from page 477.)

guard gates will also be provided, both being safeguards against the sudden release of a flood of water through the carrying away of gates or other accident.

One of the interesting features of this work will be the alterations carried out where the present Canal crosses the Welland River by means of an aqueduct. This aqueduct will be done away with, the river level raised by a dam, and its channel used for the new canal for some distance. Any surplus water from the river will be allowed to flow over the dam and willrun off through the regular river channel, entering the Niagara River at Chippewa.

At Port Weller, so named in honor of John Laing Weller, the designer of the canal, much work will be necessary before it can properly be termed a harbor. Located some three miles east of Port Dalhousie, the present terminus

(Continued on page 502.)



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## THE NEW WELLAND CANAL

(Continued from page 500)

and without natural protection, a harbor will have to be formed by means of two immense embankments of earth, extending from the canal prism into Lake Ontario for a distance of 1½ miles. These embankments will be 500 feet wide and the artificial harbor between them will be dredged out to the proper depth. At their outer extremities entrance piers will be placed.

As before mentioned, the usable length of the locks is to be 800 feet. Their width will be 80 feet; they will have a lift of 46½ feet each to make up the total rise of 325½ feet. By way of comparison one may note that at Sault Sainte Marie the Canadian lock is 800 feet in length and 60 feet wide, with a depth of water over the sills of about 21 feet. On the American side the Poe lock is 900 feet long and 100 feet wide.

The accompanying illustrations give some idea of the magnitude of the work being carried on in the Welland improvement, and of the progress made to date.

## THE STORY OF NICKEL

(Continued from page 496)

From this point on the processes used by the various companies differ widely and have nothing in common. Three separate processes for the refining and separation of the metals in the matte are in use to-day, the Mond process, the Oxford process and the Hybinette process.

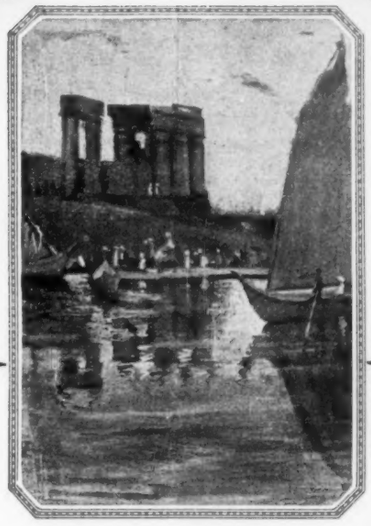
Of these the Oxford is the oldest and is the one used at the Port Colborne refinery and also at Bayonne, N.J While full details of this process have never been published it is known that it depends upon the fact that if a matte consisting of the sulphides of iron, copper, and nickel be fused with sodium sulphide or sulphate and coal (which mixture produces sodium sulphide on fusion), the product separates into two layers, of which the upper, the more fusible one, contains the double sulphides of sodium with copper and iron, while the lower one contains the greater part of the nickel sulphide present in the original matte. This separation process is repeated several times.

The Mond process works along totally different lines and makes use of an interesting chemical reaction discovered in 1889 by the late Dr.Ludwig Mond. When carbon monixide is passed over metallic nickel at a temperature of 50°, there results nickel carbonyl, a volatile compound with the formula $Ni(CO)_4$. This compound when heated above 150° decomposes again into metallic nickel and carbon monoxide and thus furnished another method for the refining of nickel.

The Bessemer matte, as received at Clydach from Ontario, is first roasted to reduce its sulphur content to about 2 per cent. The roasted material is then leached with sulphuric acid, which dissolves about 70 per cent of the copper originally present together with one or two per cent of the nickel. The undissolved residue is washed, dried, and powdered. The reduction process then follows. This is carried out in vertical towers about 40 feet high, fitted with heating means and with power-driven stirring arms. As the powdered charge descends through the tower, it is brought into contact with an upward moving stream of water gas.

The copper sulfate produced by the preliminary leaching of the roasted matte with sulfuric acid is crystallized and is sold to vine growers and potato farmers for purposes of spraying. The mother liquor remaining from the crystallization is rich in nickel sulfate, which is crystallized out separately.

The Hybinette process of refining copper-nickel matte is an electrolytic one. It has been in use at Kristiansands for several years and is being adopted at one of the Ontario works.



# *Reflections of the Nile*

Were one to drift down that lazy river and fix one's attention upon the occasional crumbling mass of architecture upon its bank, one would note that the structures are invariably low—insignificant compared with the cloud-piercing buildings of today.

Ancient builders had neither need nor facilities for building to great heights. Work was executed under the eye and supervision and within the sound of the voice of the master builder.

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